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Development of deterministic runoff prediction model for micro-watersheds of Dal Catchment of Kashmir Valley, India

OWAIS AHMAD BHAT[1], ROHITASHW KUMAR[2], MUKESH KUMAR[3] and YASIR ALTAF[4]

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ABSTRACT

The present study was conducted in five micro watersheds of Dal catchment in Kashmir valley to evaluatethe runoffyield. Linear and log linear model were developed for annual runoff. At micro level planning, watershed delineation and stream network are the preliminary steps for watershed prioritization, integrated watershed management and sustainable development of natural resources within the watershed. Geomorphological parameters of watershed have been determined, which are interrelated to parameters of watershed characteristics. The value of drainage density was comparatively on higher side ranging from 4.91-5.95 km km^2. The catchment shows low value of bifurcation ratio and the drainage pattern has not been distorted by structural disturbance. The study has shown that the watershed is in conformity with the Horton's law of stream numbers and stream lengths. The runoff developed model has close agreement between observed and predicted values at 5% level of significance. The R^2 value between mean observed and predicted runoff was 0.87 which shows close agreement between field observed and model predicated runoff value.The morphologic parameters have been proved to be efficient tools for morphometric analysis indicates the presence of dendritic drainage pattern pointing out favorable conditions in selecting the soil and water conservation measures and water harvesting systems.

Key words: Watershed, Dal catchment, morphology parameters, runoff, sediment

INTRODUCTION

India's land resources are under immense pressure, it shares only two per cent of the world's geographical area, but supports around 18% of world population and 15% of world's livestock (Kumar *et al.*, 2012). The total geographical area of India is 328 million hectares (mha), of which 69 Mha areacritically degraded, while 106 Mha area severely eroded (Singh, 2000). It has been estimated that about 16.4 ton/ha^{-1} of soil is detached annually because of various agents of destruction. Declining land availability for agriculture, which is expected to be only 0.15 ha per capita by 2035 AD shows the severity of the problem (Singh, 2000).

Hydrologists have developed large number of geomorphological parameter to describe the watershed which are often inter related to determine runoff yield. Different watershed data collected for scientific analysis of different components. The mean annual runoff is significantly correlated with drainage basin area, total stream length and first order stream frequency (Singh, 1997 and Sriniwas, 2004). To develop appropriate technology and strategy for minimizing the land degradation runoff quantification is an urgent need in the recent years (Singh, 1997; Sarangi *et al.*, 2007; Cleveland *et al.*, 2008; Liebe *et al.*, 2009; Gupta and Singh, 2010; Panday *et al.*, 2011; Richardson *et al.*, 2012). Deterministic geomorphic modelling is basic tool for prediction of hydrologic behaviour of a basin. Keeping above facts, present study was carried out to develop the deterministic runoff prediction model to evaluate effect of the different geo-morphological parameters on runoff using regression techniques.